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2016 Nebraska Corn Production Net Income Risk

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Cornhusker Economics

2016 Nebraska Corn Production Net Income Risk

Market Report	Year Ago	4 Wks Ago	2-26-16
Livestock and Products, Weekly Average			
Nebraska Slaughter Steers, 35-65% Choice, Live Weight.	158.18	132.00	*
Nebraska Feeder Steers, Med. & Large Frame, 550-600 lb.	280.88	198.24	199.98
Nebraska Feeder Steers, Med. & Large Frame 750-800 lb.	214.14	165.76	163.33
Choice Boxed Beef, 600-750 lb. Carcass.	239.47	226.24	216.51
Western Corn Belt Base Hog Price Carcass, Negotiated.	59.14	51.55	61.93
Pork Carcass Cutout, 185 lb. Carcass 51-52% Lean.	71.63	69.65	74.56
Slaughter Lambs, wooled and shorn, 135-165 lb. National.	198.75	143.71	137.07
National Carcass Lamb Cutout FOB.	361.05	359.79	347.25
Crops, Daily Spot Prices			
Wheat, No. 1, H.W. Imperial, bu.	4.83	3.93	3.65
Corn, No. 2, Yellow Nebraska City, bu.	3.67	3.33	3.32
Soybeans, No. 1, Yellow Nebraska City, bu.	9.64	8.21	8.10
Grain Sorghum, No.2, Yellow Dorchester, cwt.	7.14	5.48	5.42
Oats, No. 2, Heavy Minneapolis, Mn, bu.	3.08	2.66	2.24
Feed			
Alfalfa, Large Square Bales, Good to Premium, RFV 160-185 Northeast Nebraska, ton.	*	250.00	190.00
Alfalfa, Large Rounds, Good Platte Valley, ton.	75.00	82.50	77.50
Grass Hay, Large Rounds, Good Nebraska, ton.	92.50	85.00	85.00
Dried Distillers Grains, 10% Moisture Nebraska Average.	177.50	134.50	131.50
Wet Distillers Grains, 65-70% Moisture Nebraska Average.	58.50	51.50	51.50

*** No Market**

2016 Projected Price Forecasts:

Corn

- $3.86/ bu with a .17 volatility factor
- Down $.29/bu and .03 in volatility compared to last year

Soybeans

- $8.85 with a .12 volatility factor
- Down $.88/bu and .04 in volatility compared to last year

Nebraska corn producers are entering the production year with low grain prices, uncertainty associated with both harvest prices and yields and high production costs resulting in increased chances of financial losses than recently experienced. To help manage the risk of experiencing large financial losses, producers can purchase crop insurance which acts as a source of income when crop revenue turns out to be low. However, not all financial losses can be fully protected by crop insurance; therefore, producers are required to pick up the remainder in order to survive. The intent of this article is to provide guidance on financial risk exposure from producing corn in 2016 in Nebraska, how crop insurance can help, and more importantly derive reasonable expectations on how much money producers can expect to lose in case of experiencing a low revenue event.

The probability of financial loss is unique to the producer's production region (specific yield risk and harvest cash price), practice (irrigated or rain fed), production costs, machinery and land payment obligations, family living expense, and off-farm income. As a result, we examine and compare the probability of financial loss in two counties, over two production practices, using region-specific producer costs. While

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this approach does not account for all of the variability between farms, it does allow for more accurate assessment of region-specific variables such as revenue risk exposure as well as production and financial data. Both counties contain different agronomic and economic conditions with Saunders County located in the east and Custer County in the west central. Both counties raise irrigated corn. Saunders County produces both irrigated and rain-fed corn. Production costs and financial data are specific to region and production practice. The model presented here simplifies a very complicated financial environment in order to uncover important relations between farms and crop insurance.

In the first part of the article, we identify the range of harvest revenue (yield and price) outcomes to describe risk exposure. We then identify the range of net income by subtracting average per acre crop production costs, depreciation, and family living expense, while adding back in off farm income. We then construct a simulation model with 30,000 iterations (each iteration represents a possible harvest yield and price) applying a variety of crop insurance contracts to evaluate changes in risk exposure. We model risk using the 5% (1 in 20 event) expected shortfall (ES) risk measure. The ES risk measure represents the average loss once a loss occurs.

Using the National Agricultural Statistics Service (NASS) county historical yields from 1975 to 2014, we construct a county level yield distribution for each county and practice. Yields are de-trended to represent yield risk for the upcoming year. We investigate price risk through the use of commodity market option prices. This approach incorporates what the commodity market views as price risk. Historical data from 1975 to 2014 is used to identify the correlation between the futures price on Dec 1st and the county yield.

Production and financial data come from Nebraska Farm Business Inc. (NFB). NFB works with individual producers across the state analyzing their financial data to give the producers invaluable financial data they can use to benchmark their farms and improve their profitability. NFB breaks production and financial data into four regions in Nebraska. Saunders County is located in the Northeast region and Custer County is located in the West region. Average production costs and practices in each region are used in the analysis. For financial data, we use the average value which varies between regions. In order to identify production costs, we made a number of assumptions. Producers with principal payment obligations on equipment or land this fall face different risks than producers who have paid off their equipment and are experiencing depreciation. Although individual situations will vary, the NFB data shows both depreciation and interest cost and equipment and land principal payments are nearly equal on the average. As a result, our expense value in the analysis contains both types of producers. We do not account for opportunity cost of renting land because this is not a cash cost. Family living, taxes, and off-farm income is regional

For crop insurance we focus on one policy type, Revenue Protection (RP) and two coverage levels (75% and 85%). While other perfectly applicable contract choices exist we focus on these based on contract popularity and article brevity. RP protects price in addition to yield, 75% coverage level is commonly selected and 85% is selected to because it represents the highest value of revenue risk transfer a producer can make. Both Trend Adjustment Actual Production History (TA-APH) and Yield Exclusion (YE) policy endorsements were selected.

Results

Table 1 presents county and production-practice-specific data. Results indicate direct and allocated production expense data varies greater between production practices than between locations. The opposite was found for family living plus taxes minus off-farm income where location mattered more with the west having a substantially lower cost. It was no surprise production costs were the lowest in rain-fed conditions, followed by irrigated corn production in Custer County and finally irrigated corn in Saunders County. Focusing on production data, specifically expected yield, values vary greater between production practices than between locations. Differences were found with the minimum yield. For irrigation, the minimum yield in Saunders County is much lower than the minimum yield in Custer County. Saunders County irrigated corn production is more risky than Custer County irrigated corn production. As expected, minimum yield in the rain-fed production practice deviates substantially from what is expected, a result indicating high production risk. Custer County fall cash price, on average, is lower than Saunders County, a result driven by lower historical basis. Price yield correlation value provides evidence on the strength of the 'natural hedge' or the responsiveness of prices from experiencing a low yield. Rain-fed conditions provide the strongest value, which is to be expected given the lack of irrigation and proximity to the Corn Belt. Moving west, away from the Corn Belt lowers the 'natural hedge', as one would expect with increased weather variation over space. Estimated crop insurance premiums turn out as expected with higher premiums in the higher risk production environment - rain fed production. As usual premiums decline as coverage levels decline.

Table 1. Summary Statistics			
	Location and Production Practice		
	Saunders County Irrigated	Saunders County Rain fed	Custer County Irrigated
Expense			
Direct and Allocated Production Expense, $/acre	$654.61	$506.22	$652.95
Family Living and Taxes minus off farm income, $/acre	$84.80	$84.80	$38.90
Total Expense, $/acre	$739.41	$591.02	$691.85
Production Data			
Expected Yield, bu/acre	202.2	150.3	200.4
Minimum Yield, bu/acre	128.7	52.11	151.6
Expected Harvest Cash Price, $/bu	$3.73	$3.73	$3.65
Price-Yield Correlation	-.35	-.51	-.22
Crop Insurance Data			
Actual Production History	202.2	150.3	200.4
Policy Endorsements	TA-APH, YE	TA-APH, YE	TA-APH, YE
*Revenue Protection Premiums, $/acre**			
85% Coverage Level	$26.18	$37.96	$25.59
80% Coverage Level	$16.88	$25.61	$16.30
75% Coverage Level	$10.80	$17.53	$10.35
70% Coverage Level	$7.18	$12.49	$6.85
65% Coverage Level	$5.14	$9.86	$4.89
60% Coverage Level	$3.25	$7.03	$3.13

Notes: * Based on optional unit structure

Figure 1 presents net income exposure with two crop insurance contracts and without insurance for Saunders County irrigated corn production in 2016. A number of valuable insights come from Figure 1. First, the probability of making money, i.e., zero net income, is slightly less than 50% and selecting a crop insurance policy lowers the probability of making money. Consequently, Saunders County irrigated corn producers must have capital on hand to survive even with crop insurance. Focusing on rare, financially bad events, such as a 5% ES, a producer must have on hand $144.00/acre to survive with an 85% RP crop insurance policy (average net income value below the intersection of 85% RP policy and 5% probability, point "A", Figure 1, stated in Table 2). Without crop insurance this value increases to $247.60/acre, Table 2. RP at 85% Coverage Level (CL) protection on $103.60/acre ($246.60 - $144.60) of income. A 10% drop in coverage level from 85% to 75% increases the amount of capital by $53.20/acre. As expected, rain-fed corn production contains the highest 5% ES net income risk of $274.20/acre and the second largest protection from crop insurance at $106.50/acre using an RP 85% CL policy. Custer County irrigated corn results provide the largest benefit from a RP 85% CL policy of $112.50/acre and Saunders County irrigated with the smallest benefit of $103.60/acre. RP 85% CL policy risk management benefits across two locations and two production practices were found to be similar in size. Figures 2 and 3 present net income probabilities for rain-fed conditions in Saunders County and irrigation in Custer County.

Results indicate that rain-fed corn production requires the largest amount of capital on hand to survive, $167.70/acre with a RP 85% CL policy. Using the same insurance contract with irrigation, RP 85% CL, Custer County resulted in a smaller net income risk of $115.20/acre vs. Saunders County of $144.00/acre. This result is being driven by higher minimum yield in Custer County (i.e., lower risk) and a substantially smaller net difference between family living plus taxes minus off-farm income between both regions. As a result, caution is needed in generalizing results to specific farms. Zero off-farm income in Custer County or substantially higher family living (and taxes) will require larger amounts of working capital to survive a bad event than presented here.

Overall, results indicate large differences in production costs and financial costs between regions across both regions and production practices. While we found similar 5% ES risk benefits from crop insurance, the amount of capital on hand to survive varied greatly, thereby reinforcing the fact that producers must consider their own farm characteristics in making the crop insurance decision. There are a number of important factors this article does not consider. First, we do not take into account financial standing. It takes wealth to survive a bad event. Selecting a low coverage level with low wealth lowers the probability of surviving a rare financially devastating event. Second, we assume Actual Production History (APH) equals expected yield. Financial benefits from crop insurance decline as APH drifts lower from expected yield. Consider this difference the 'hidden deductible' and calculate your personal 'hidden deductible' to evaluate usefulness of your crop insurance policy. Third, we do not consider the Farm Bill. It is likely an ARC-Co corn payment will be made this year. This additional income source lowers all outcomes by the value of the payment. Fourth, we do not consider pre-harvest hedging impacts on risk and expected income. The relation between hedging, crop insurance and farm characteristics is a task left to a future Cornhusker Economics article. With the capital it takes to produce corn, it requires a solid understanding of the relation between available risk management tools and unique farm characteristics to make an informed decision providing the highest probability of farm survival.

Table 2. Net Income Risk (5% ES) Results with and without Crop Insurance, $/acre.

	Location and Production Practice		
	Saunders County Irrigated	Saunders County Rain fed	Custer County Irrigated
Net Income Risk (5% probability event) without crop insurance	$247.60	$274.20	$227.70
Net Income Risk with 85% Coverage Level (CL)	$144.00	$167.70	$115.20
Net Income Risk with 75% CL	$197.20	$190.40	$171.00
Net Income risk protection with crop insurance			
With 85% Coverage Level (no ins – 85% CL)	$103.60	$106.50	$112.50
With 75% Coverage Level (no Ins – 75% CL)	$50.40	$83.80	$56.70
Additional capital required to drop coverage level 85% to 75%	$53.20	$22.70	$55.80

Figure 1. Irrigated Saunders Co Net Income Risk Cumulative Distribution Function with two insurance contracts and without Insurance.

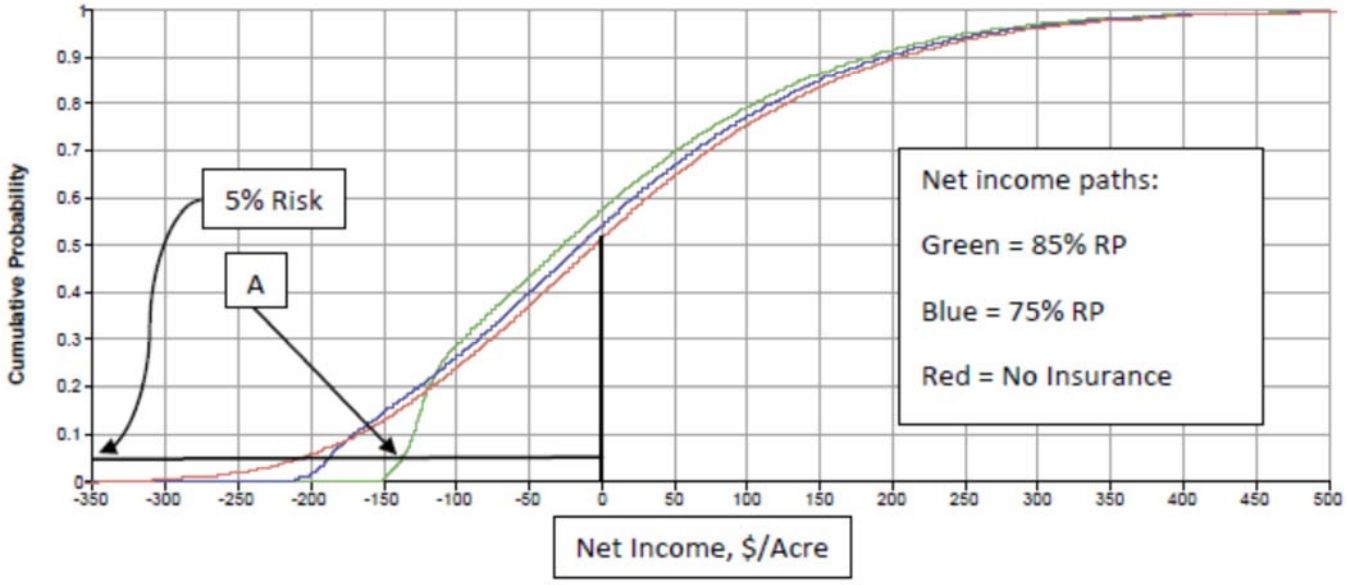


Figure 2. Rain Fed Saunders Co Net Income Risk Cumulative Distribution Function with two insurance contracts and without Insurance.

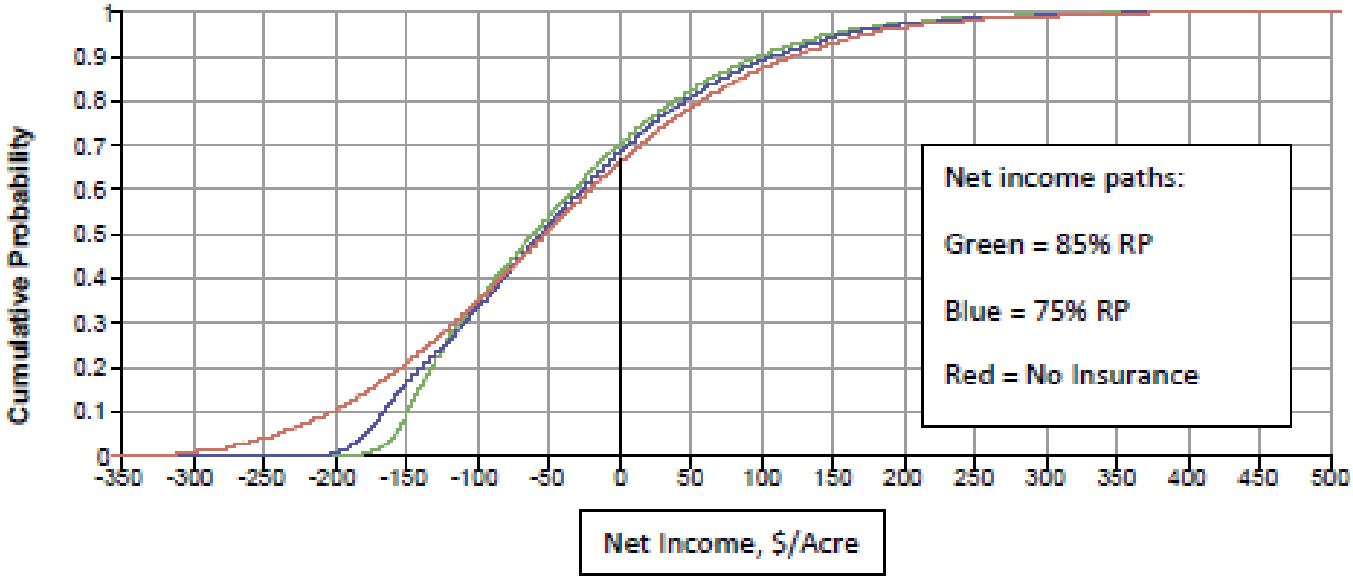
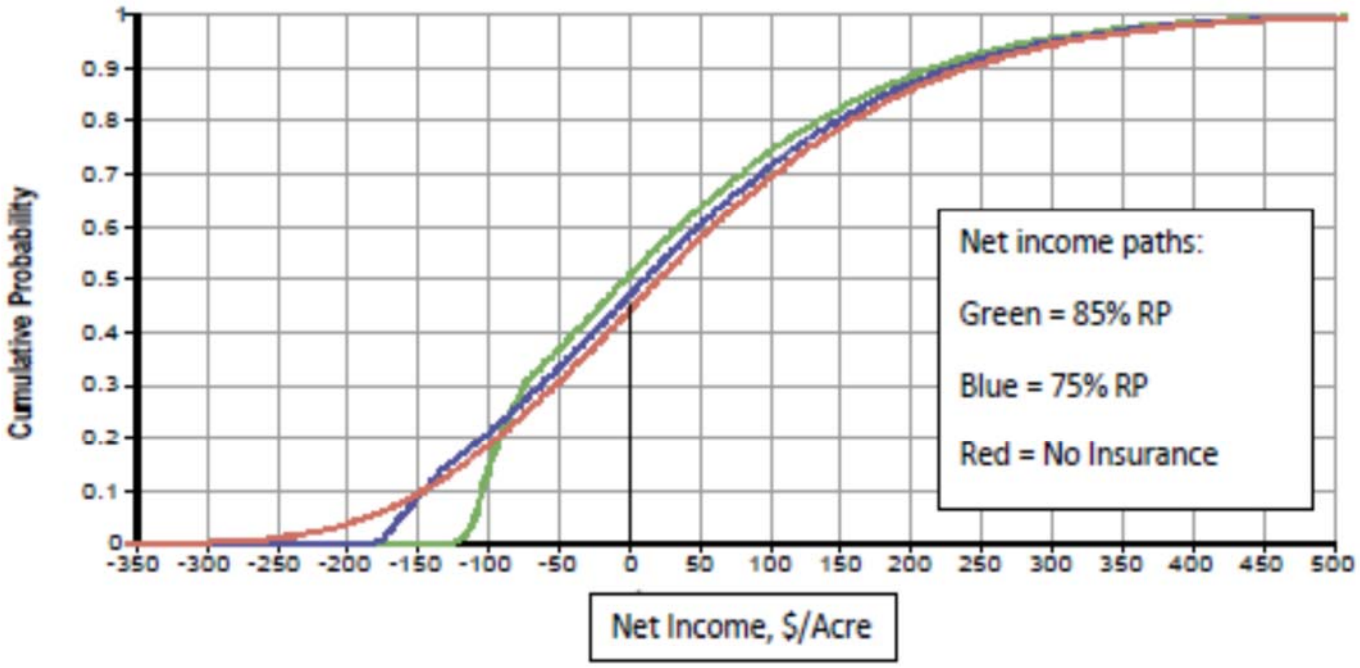


Figure 3. Irrigated Custer County Net Income Risk Cumulative Distribution Function with two insurance contracts and without Insurance.



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